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STARTING Over

While the first block downconversion receivers were introduced in 1978, and the first home TVRO block receivers appeared in 1981, it has only been during the last 10 to 12 months that the block downconversion concept has really caught on in TVRO. And there are many dealers who find the block concept difficult to understand and therefore difficult to properly employ. Much of the confusion concerning block downconversion originates in a lack of user understanding as to what block conversion is, and how it differs from the original 70 MHz (single conversion) concept pioneered first by Robert Coleman and then tidied-up by David Barker in 1980.

Let's start with the single conversion package since many of our references in explaining block conversion go back to the original single conversion system.

1) Satellite television is transmitted in a series of consecutively placed but independently operated downlink channels. These channels are each 40 MHz 'wide' and they are in the region of 3.7 to 4.2 GHz (also the same as 3,700 MHz to 4,200 MHz).

2) Each of these channels (or transponders) does its own thing, and each channel is tied to all of the other channels in the same satellite through a common sharing of such satellite parts as the antennas, the power supplies, and the control systems.

3) The transmitting power we see on earth from any single channel is a function of ~~two~~ several factors, including:

   A) The maximum power available for any specific transponder (typically 5, 7.5, 8 or 9 watts for US domestic satellites), and,

   B) The strength of the uplink signal, from the originating program source, which sends the program material to the satellite.

Certain transponders are designed for maximum transmitter powers of 5 watts (example: transponders 1,5,9,13,17,21 on F3R) while others may have powers as great as 11 watts (example: ANIK D transponders). However, the owner of the satellite (example: RCA) may issue special instructions to the user of a certain channel to 'throttle back' the uplink power to keep the transmitter power at some number lower than the full rating (example: CBN on TR8 of F3R). This 'throttle-back' instruction may be caused by a fear that some part of the transponder is heading for premature failure (cutting back the power by reducing the uplink signal to the satellite will extend the life of the transponder), or a concern that some shared segment of the satellite (such as a powering system) is overtaxed and by cutting back on individual transmitter powers the shared power source may last longer.

Therefore as a satellite ages, we begin to 'measure' (by measuring the received signal strengths at a TVRO) some distinct differences in signal levels or strengths. And as the satellite continues the aging process, closer and closer to the 7 to 10 year 'lifetime' anticipated for a ~~full~~ mature satellite, these differences in satellite signal 'strength', between channels or transponders which are supposed to be 'equal', increases. This variation in signal levels is more pronounced with the older generation satellites (example: F3R, Westar 5) than with the

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newer generation satellites (example: Galaxy 1). Still other 'newer generation' satellites, such as Telstar 3 used a hybrid technology for their transmitter amplifier powering systems and these 'hybrid birds' will in time exhibit even greater variations in signal levels as the satellites age.

Satellites age in several ways. Every satellite is dependent upon its 'fuel' supply and its 'powering system' for long term use. The fueling system is a small supply of hydrazine gas which is allowed to escape from miniature thrusters (rocket tubes) built into three faces of the satellite. These jets of fuel are commanded ~~from~~ AT the satellite by ground controllers at regular intervals to insure that the satellite 'maintains station'; ie. it stays more or less in space where it is supposed to be. Several forces in space act constantly upon the satellite's position; gravity is the greatest of these and land mass areas on the ground (example: South America) exert a tiny but constant pull on the satellites. Left alone, all of the satellites serving North America would gradually drift to a position near 104 west where they would cluster from the gravity. Satellites east of 104 west must be 'kicked back' to their assigned slot in space every 15 to 30 days by the careful firing of the hydrazine thrusters. And those west have the same repeated rocket thruster firings except they are ~~kicked~~ PUSHED back to the west.

Hydrazine fuel carried on board the satellite will eventually be used up (a small amount also escapes from the containers on board). But the real lifetime of a satellite is usually determined not by the spent hydrazine fuel (once the fuel is gone, the satellite can no longer be controlled and the last bit of fuel is used to kick the satellite 'out of Clarke Orbit' and higher into space where a considerable junk yard of spent birds is already collecting); rather, the lifetime is determined by the electronics on board.

There were two critical 'time clocks' in the original satellites. One was something called a 'traveling wave tube' or TWT(A) for short. The TWT is the power amplifier which creates the 5 (7, 7.5, 8,9,11, etc.) watt transmission source for each channel. There is one TWT(A) for each channel or transponder on board and in newer satellites a 24 channel bird may have six 'spare' TWT(A) units in place ready to switch in by remote control from earth should one of the TWT(A) units fail prematurely. The second time clock on board is the solar panel powering cells and their associated rechargeable batteries. A satellite opens up sizeable flat panels of solar cells once it achieves its proper geostationary (Clarke) orbit location and those solar panels are directed to follow (track) the sun in outer space. The tracking system must be quite precise to insure that the sun's rays strike the solar cell panels at the angle which best transfers energy from the sun's rays to the panels. This requires a bit of high technology to keep the panels pointing directly at the sun at all times.

Solar panels wear with time; tiny dust particles in space wear away at the surfaces causing the cells to gradually receive less sunlight. The cells themselves, which convert sunlight into (DC) electricity also lose efficiency in time. However, the weak link in the chain is the battery storeage system which receives the DC voltage from the panels and stores that voltage (as a current) for satellite use. The satellites cannot convert sunlight to DC and use that DC in 'real time' because there are periods each year (two) when the sun is blocked from the satellite

the earth. During these 'eclipse' periods there can be several hours when the satellite gets no sunlight (and therefore no power) at all. The satellite's battery storeage system must be adequate to insure that during these eclipse periods the satellites still operate. In older satellites, such as Westar 1,2 and 3, it was necessary to reduce the number of channels/transponders in use during the eclipse period to insure that the batteries did not run out of power before the sun came back in view. More recent satellites are equipped with larger battery and larger storeage systems to allow full, uninterrupted, service during an eclipse period.

Batteries, even extremely high tech batteries, which operate for up to ten years going through never-ending charging/discharging/recharging cycles eventually wear out. The condition (the charging rate, and the discharging rate) for all batteries on a satellite is under constant surveillance by ground flight controllers. In fact, a satellite is 'flown' by a flight controller 24 hours per day, 365 days per year. The flight controllers monitor, using a technique called telemetering, as many as 200 different important measurement points in a satellite constantly, and using uplink telemetering commands, make small adjustments in the satellite's 'attitude' several times per day to correct for variations in satellite operation.

So as a satellite ages, and the expected or unexpected decay takes place in the satellite's TWT(A), battery, solar panel and other component sections, greater and greater precision is required by the flight controllers on the ground. Sometimes there are mistakes in the flight control commands and satellites momentary shut down service (example: RCA's F2 satellite turned over briskly one day and pointed in the wrong direction, away from earth, for several hours time).

TVRO users, with small dish antennas which are perhaps 'marginal' in size to produce quality pictures when a satellite is brand new and everything is working perfectly, quickly notice this 'aging process' of a satellite. And when there is a change in the satellite's attitude, or its operating condition, even if only for a few minutes time, the small dish systems see these changes first because there is a lack of something called 'margin' in the receiving system. Margin? Extra system gain, not needed for a new satellite or when a satellite is operating exactly perfectly, but much needed when the satellite ages or momentarily points in a slightly off-boresight direction.

The TVRO dealer cannot be expected to fully understand all of the nuances of hour by hour and year by year satellite variations. What he should appreciate, however, is that the satellite system he depends upon for 'stable, solid service' is subject to both human and mechanical/electrical error and problems and the smaller the dish (ie. marginal), the quicker these variations will be noticed. Additionally, the further the TVRO dish is located from the so-called 'boresight' location, the quicker pointing or attitude errors or changes will also be noticed.

All of this becomes increasingly important when you begin to juggle the antenna/LNA/receiver combinations which seem to produce satisfactory performance in your area in North America. And when receiver systems adopted the block downconversion techniques, entirely new 'variable elements' were introduced into the system equation. The dealer, to sort out his installation practices, procedures and problems, needs to appreciate the complexity of the entire 'system link' which really begins at the uplink transmitter and really ends after the signal has traveled some 45,000 miles through space (up to the satellite, and back again) at the dish system you are installing.

THE BDC 'Difference'

The satellite system you are installing is the only variable or 'adjustable function' in the satellite link equation over which you have any control. There is a formula which allows the computation of 'path loss' and 'system gain'; use of this formula will illustrate that if you have a specified 'footprint signal level' at a given location, quality reception will result only when you design a receive system with some formula-derived minimum amount of gain. You achieve this 'gain' in several areas in the receive system:

A) Antenna gain, measured in dB(i) or so many decibels of gain;

B) LNA gain, measured in dB;

C) Receiver gain, also measured in dB.

Let's say you worked the formula and found that for a quality picture you required 100 dB of total gain at the receive location. Could you not trade off gain within the LNA and/or receiver for gain in the antenna, thereby 'getting by' with a smaller antenna? That is a logical, if uninformed deduction.

There is another entry into the system equation and it involves an operating parameter known as carrier to noise ratio. The signal, coming from the satellite, is the carrier part. Noise, or an absence of signal but the presence of interfering signals originating in space itself, the earth and the electronic equipment, is the other half of the carrier to noise ratio. For a high quality picture, one with no noise present in the picture, there must be a minimum carrier to noise ratio. That number will vary between 7 (dB) and 10 (dB) depending upon the receiver's internal circuits.

The ratio, carrier to noise, is the result of taking a measurement of the signal with a meter device, and then taking a second measurement of the amount of noise in the receiver system. These two measurements are done in the decibel 'power units' and with the appropriate instruments you end up with two decibel (dB) numbers. There needs to be 7 (10) more dBs of signal than noise for our receive system to work properly.

The antenna gain, in dB, is 'passive'; that is, the gain achieved in the antenna is done without electricity or 'active amplification'. Gain created in the system after the antenna, in the LNA or downconverter or receiver proper, is 'active gain'; that is, this gain is created with circuits operating from electricity. Here is the key here:

'All active circuits amplify both the noise and the signal present, and the amplification itself adds still additional noise to the carrier to noise ratio present'.

Why?

Because all electricity-operated circuits create their own noise, no matter how good the circuits may be. One entire segment of the TVRO system, the LNA (low noise amplifier), has been designed around minimizing the noise contribution to the system. In a TVRO system, reducing the noise content is a prime consideration and special amplification devices (called GaAs-FETs) are selected for that very purpose.

If an active stage, in the LNA, downconverter or receiver, will increase both the noise and the signal, and in the process of amplification the noise will actually increase slightly

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more than the signal increases, how then do we increase the carrier to noise ratio without adding more noise? The answer is the antenna.

The satellite antenna reflector intercepts signal from the satellite itself. Think of the reflector surface as a sail in the wind; a larger sail catches more wind than a smaller sail. A larger antenna reflector surface catches more satellite signal than a smaller antenna reflector surface. Additionally, because of the 'focusing' or beamwidth properties of the antenna reflector, as the antenna reflector surface is made larger and larger, the amount of noise captured by the reflector actually diminishes. Therefore, when you trade a six foot reflector for a 4 foot reflector, you are increasing the signal at the same time you are decreasing the noise. This follows through for any increase in antenna size; a larger reflector captures more signal and less noise than a smaller reflector.

There is no way to increase the carrier to noise ratio other than increasing the passive gain of the antenna. Adding more system gain, electronic gain created by active electricity driven circuits, after the antenna increases the noise and the signal at the same time and by act of active amplification also decreases the carrier to noise ratio because each amplifier stage or section adds additional noise to the composite signal plus noise 'package'.

This is basic to any TVRO receive system regardless of the type of receiver design employed. However, the carrier to noise relationship which is key to producing high quality pictures from space becomes more complex in a BDC (block downconversion) system. Let's see why.

RUN And Split

The carrier to noise ratio (CNR) is maintained in a system right up to a section of the receiver called the demodulator. This is after the antenna, the LNA, the downconverter/block converter, the receiver amplifier(s), the receiver filters, and a host of other receiver circuits including the AGC (automatic gain control). It is important to remember that the original FM (frequency modulation) format of the uplink transmitted signal remains intact, just as it leaves the uplink antenna, all the way to the input to the demodulator section of the receiver proper in your TVRO.

This means that any 'processing' you do of the signal, prior to the demodulator, can and will have some impact upon the carrier to noise ratio. Also recall that each time you amplify a signal, using an 'active' electricity-driven circuit, you are contributing (new) additional noise to the composite signal + noise package. Ideally, a system would be designed so that you extracted picture and sound from the composite signal before you did any amplification at all since all amplification adds (and distorts) to the noise originally present.

The primary gain in any system is the antenna gain. As we saw, gain added after the antenna trades off more noise for more gain. In a BDC system, the lure of BDC is that an entire block or group of transponders are treated simultaneously by the conversion and amplification proces And this allows the installer/user to independently access individual transponders with individual receivers each connected to a common antenna.

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Alas, there is a price to be paid here.

The concept behind BDC systems is that by downconverting the full 500 MHz satellite frequency (downlink) band from its original 3,700/4,200 MHz range to a lower (IF or intermediate frequency) range, the new IF band can be amplified and signal-voltage-split again and again to drive a coaxial cable distribution network serving multiple receiver locations. We diagram that for you here.

NOISE 'vs' Noise

There are two separate types or categories of noise in a system such as this. You might characterize source 'A' as:

"Noise caused by a lack of signal...", and you might characterize source 'B as

"Noise caused by an abundance of signal".

What is that all about?

When the carrier to noise ratio at the antenna is too small, there is a shortage of carrier (and therefore an abundance of noise) in the system. We see that type of noise as 'sparklies' or we see tearing edges on sharply defined images on the screen accompanied by picture 'jitter'. The solution to this sort of picture is a larger antenna.

When the carrier to noise at the antenna is adequate, but within the system between the LNA input and the demodulator (stage) input there is excessive amplification, the system pictures suffer because the carrier to noise ratio suffers from the amplification-added noise. This type of noise can be seen as a fine-grain 'busy-ness' which is most apparent at close-in viewing distances (ie. up close to the screen).

Sparklies are caused by an initial lack of signal and the cure is a larger antenna, or in marginal situations a lower noise LNA. Fine-grain noise is caused by a 'noise build-up' created within the receiver/cable distribution system and the cure is the subject of this report.

NOISE Factor

Every amplifier stage within a system has some measureable 'noise factor'. In the LNA world, we measure the noise factor by using the Kelvin temperature scale. So much noise equals some equivilent amount of noise temperature (such as 100°K). In virtually all other sections of the TVRO system, we measure noise on another scale called 'noise figure'. Here, the measurement is done in dB or decibels once again.

Both systems have a common heritage and actually it is the scale of measurement that differs and not the approach to the measurement. In either degrees K or dB a lower noise number means a better circuit. Ideally, there would be 0°K or 0 dB noise in an amplifier. No such ideal amplifier has ever been created and in fact none will ever be created since the motion of (electrical) molecules in a circuit sets atoms into motion and that motion creates noise all by itself.

With appropriate measurement equipment, it is possible to determine the amount of noise in a circuit or amplifier stage. LNAs routinely are subjected to this type of measurement; that's where the noise factor (85°K, 100°K, etc.) specification or rating comes from. The same type of measurement is just as important in our balance-of-receive-system equipment as well. But, unfortunately, such measurements are not always performed on the balance

of a system and with no such numbers stated on the unit or in the literature, the job of the system planner can be quite difficult. Let's see why, and what problems we can get ourselves into when we don't know enough about the equipment we are working with.

NOISE Build-Up

There are two system-design foes faced by every builder of a cable television system:

1) Noise build-up, and,

2) Cross-modulation.

Both have a common root and as the distinctions between cable TV and TVRO blur, we are starting to run into both problems with our 'shared antenna' or BDC systems as well. Most TVRO practioners have never heard of noise build-up nor cross-mod. Consider this your first lesson in both.

Remember that ~~every~~ Each time a signal is passed through an amplifier, the signal gets stronger and the noise gets stronger. The amplification circuits cannot distinguish between true signal and noise so both are amplified equally. If we amplify the signal 20 dB, we amplify the noise 20 dB as well. The saving factor here is that the signal was (hopefully) stronger than the noise to begin with so when each increase by 20 dB the ratio between the signal, and the noise, should not change. Only the amount of signal, and the amount of noise, changes. But the ratio, on paper or in theory, stays essentially the same.

But essentially the same is not exactly the same as 'no change'.

Each amplifier stage has its own noise factor. And it imparts some of that noise factor to the noise already present in the amplification process. The change is slight, but in a series of amplifiers there is a build up of additional (new) noise as the signal(s) is amplified, amplified again, and re-amplified.

Some numbers. Let's assume we have a 10 dB carrier to noise ratio in the first amplifier stage input, after the LNA. That would normally be in the input to the downconverter. Let's assume something that is valid only for this discussion; that the downconverter adds no noise of its own, but merely shifts the frequency of the signal(s) from the 4 GHz band to a new (IF) band of say 950 (to 1450) MHz. Now we have a BDC distribution system consisting of some number of amplifiers, splitters and taps. Our BDC downconverter shifts the input frequency downward, sends it on its way in the 950-1450 MHz region. We diagram that for you here.

But the cable losses are quite high at 950 (-1450) MHz so we need some amplifiers to carry the signal through the high loss cable and to reach our more distant TVRO receivers connected to the system. Without much thought, we select a handful of 20 dB gain BDC IF 'amps' and proceed to wire up the system. At the end of the line, our pictures look 'grainy'; they have a fine-dot type of noise which looks like a film laying over the top of the video. The closer you get to the screen, the more the noise stands out.

If we could measure our carrier to noise ratio, we would quickly see what has happened here. In the process of selecting our 950-1450 MHz 20 dB gain line amplifiers, we have chosen amplifiers with too high an internal noise factor (or noise figure, measured in 'dB noise figure'). And we have totally ignored a basic law of cable system plant design.

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WHEN We Double The Amplifiers

A strange, but predictable, thing occurs when you start sticking amplifiers in a line or row on a cable distribution plant. Each time you double the number of amplifiers in the series or line, the noise factor increases by a significant amount. In a standard cable TV plant, engineers know that if they have a certain signal to noise (their equivilent of our carrier to noise) ratio of say 48 dB when they start out, after two amplifiers the signal to noise will be 3 dB worse, or 45 dB. After 4 amplifiers, the signal to noise will be another 3 dB worse or 42 dB. Each time the number of amplifiers is doubled, the signal to noise ratio typically goes down by 3 dB. In other words, the noise from the amplifiers while perhaps only marginally significant on a per-amplifier basis, doubles in a predictable way as the number of amplifiers itself doubles.

A careful study of our existing BDC systems, a simple BDC system, will reveal the following:

1) Most BDC downconverters have an amplifier stage built into the downconverter. The downconverter consists of a mixer driven by a fixed frequency oscillator, and then after the frequency conversion, a stage (or more) of signal amplification for the new IF signal(s); whether they are 400-900, 950-1450 or some other chosen IF range.
2) Inside the receiver proper, typically indoors of course, we have an input stage which consists of another IF amplifier stage. Like the unit outdoors in the downconverter/LNB, this IF stage adds gain and some noise to the system equation.

So even before we start off with adding new, external BDC-IF amplifiers along the cable to get the signal inside and to the various TVRO receivers connected to the system, we have two stages of IF amplification in the system. That means we have degraded or reduced the carrier to noise ratio in the system with our IF amplification unavoidably.

Now fortunately for us, the contribution of noise in a frequency modulated system (ie. a system which is processing and passing signals which are FM rather than AM) is significantly more manageable than the cable TV people find things. This means we can be more tolerant of noise sources. It does not mean we can ignore the degradation of noise coming from IF line amplifiers. In fact, you can use this rule of thumb:

"If you can see a fine grain type of noise on the pictures, you know that you have a system (downconverter, line-amplifier or receiver) amplifier noise figure problem. There is an accumulation of 'noise factor' in the system and no amount of improvement in the LNA noise temperature nor in antenna gain will resolve ~~the~~ this problem."

And then there is cross-modulation. Every amplifier stage is designed to have a certain amount of gain. Let's call it 10 dB since many of the small cable amplifiers created for TVRO distribution have this amount of gain. Gain alone is not the only criteria we must be concerned with, however.

1) Every amplifier unit is rated in its gain ability;
2) Every amplifier unit is rated in noise figure or factor;
3) Every amplifier is rated for its maximum output.

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'Maximum output' is the potential culprit. Here's why.

An amplifier uses transistors which have a certain amount of gain, when placed in a specified circuit, over a given (specified) frequency range or band. The transistor(s) in the amplifier has a specified operating voltage (such as 12 volts DC) and a specified operating current (in mils or thousanths of an amp). The sum of the operating voltage and the operating current equals 'power'. For example, 12 volts operating voltage and 20 mils operating current equals 12 X 20 or 240. In this case, it happens to be .240 of a watt. And this numerical sum is the total amount of power which the transistor will 'dissippate' or turn into heat in the amplification process.

Why should you care about the heat? No, not because heat causes equipment to quit.

The transistor(s) in the amplifier have maximum ratings. Let's say the operating current in the transistor stage changed; upwards. Rather than being 20 mils, it suddenly became 30 mils. Now the transistor is dissipating (creating) .360 watts of heat. That's a 50% increase. What happens given this change in operating condition? The transistor may 'break', like a fuse will 'snap' or melt. It is important, then, that the specified operating conditions be maintained and not exceeded if we want the amplifier to function as it was designed to function.

Now suppose that we do something else with that amplifier which we should not do; like 'overdrive' the amplifier. What does that mean?

Just as the amplifier has a specified power dissippation rating, it also has a maximum output power rating. Perhaps the output rating is +30 dBmV. And the amplifier has 10 dB of gain. That simply means that if +30 is the maximum output allowed, and we will amplify the signal fed into the amplifier by 10 dB, the maximum input the amplifier will stand is +20 dBmV. How's that?

+30, minus 10, is +20. It is just that simple.

So how do you avoid this problem? You overdrive an amplifier, go into the amplifier with too much signal, by placing an amplifier too close to a preceding amplifier. You would not connect two amplifiers together, back to back for example, because in doing so the output of the first amplifier would be too strong to pass through the second amplifier, be amplified by 10 dB, and not come out at a stronger signal level than the second amplifier was capable of handling.

In an 'AM' or standard TV distribution system, when you make this mistake you see the video from one TV signal being super-imposed on top of the video from another TV signal. Typically, the video (modulation) from the strongest TV signal passing through the amplifier marries itself to the video signal of the weaker signals going through the same amplifier.

In an FM system, the kind we have in TVRO, having too much amplification and therefore exceeding the rated output of an amplifier stage (whether it is in a line amplifier or in a receiver proper) creates a slightly different type of visual problem; pseudo-sparklies.

When an amplifier is overdriven in the 'FM service', we see pictures that should be clear and sharp take on a noisy appearence not unlike what we have if we are trying to squeeze by with a too small antenna. The noise part of the received composite signal 'shotguns' on top of the

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deo and the picture(s) degrades quickly.

This overdriving condition can occur at the receiver(s) proper, or it may happen back at an amplifier in the line between the receiver and the antenna. If you are using receivers with an adjustable IF gain control, or with an input RF attenuator, you should first check for overdriving at the receiver by simply turning down the gain or attenuator control at the receiver. However, if this does not work, it is not proof that you are not overdriving. If the overdriving (cross-modulation) is occuring in a line amplifier ahead of the receiver itself, turning down the gain or increasing the attenuation at the receiver will not cure the problem. The problem must be corrected by reducing the amplifier output level) at the stage or unit where it is occuring.

Here is a sequence of steps to try when troubleshooting a suspected overdrive situation:

1) Reduce the receiver gain with its input IF gain control and/or its input (IF) attenuator;
2) Remove a line amplifier, especially one that may be too closely 'spaced' to the amplifier ahead of it in the system;
3) Check your operating voltage on the cable line; if it is higher than the line amplifier requires, you may be exceeding the power dissipation rating on an amplifier and therefore changing the amplifier operating condition(s);
4) Take a fixed attenuator, equal to 25 to 50% of the gain rating of a line amplifier (ie. 10 dB pad for a 20 dB amplifier) and try placing it at the input of each line amplifier between the receiver and the origination point for the block IF signal (ie. output of downconverter or LNB). Note that the pad must be 'power passing' and be capable of functioning at the operating frequency of the block IF (ie. good to 1450 MHz for high block IFs).

In each case, you concern is that you are not overdriving an amplifier stage, giving it too ch signal to amplify and therefore exceeding its output rating. Remember that the receiver has IF amplifier stage at its input and this amplifier stage can exhibit the same type of overive condition as a line amplifier located along the coaxial cable itself.

Too much signal, then, can be just as troublesome as too little signal when you are dealing th any 'active' (electricity-operated) gain or amplifier stage. And the symptoms (ie. picture that sults) can also be very similar leading the installer to make an incorrect assumption about the e to the problem (additional gain will definently not solve this one!). In fact a number of ckaged systems now available to dealers are especially susceptible to 'overdrive' and require ecial care when installing. The Uniden 7000 unit, for example, can be overdriven if you use a 50 dB n range LNA and also close-space or short-space the LNB or downconverter to the receiver pro-.

In this situation, the engineers designing the Uniden system planned for a minimum amount of le loss or attenuation between the output of the downconverter and the input to the receiver per. Their gain stages between the LNA/LNB and the demodulator section of the receiver were ated based upon that minimum amount of loss. When an installation adds additional gain and/or less than the planned for cable loss from outdoors to indoors, the receiver is overloaded by signal voltage present. The carrier to noise ratio, the ultimate measurement of picture qual-, is degraded by the overdrive condition and noisy pictures result.

Line amplifiers, then, should be used sparingly, when required but not as a 'cure-all' to BDC system cable losses. There is such a thing as too much system gain and the installer who tacks on unneeded line amplifiers is causing himself and his customers needless problems. There is one more problem related to line amplifiers to note:

All line amplifiers will have a minimum (and maximum) specified line operating powering voltage. A 12 volt minimum is common while others state they must have 18 volts (DC) to operate properly.

Line amplifiers do not suddenly 'quit working', as a rule, when the line powering voltage drops to a below-specified-minimum level. Rather, the amplifier characteristics change. For example:

1) Too low line voltage can reduce the output capability of a line amp (ie. where the specified output is +30 dBmV, the actual permissible output now becomes +26 dBmV). If you are pushed into a corner and must operate a line amp on below-specified line voltage, also reduce (pad) the input signal to cut back on the total output available, thereby reducing the 'heat' generated by the amplifier stage.

2) Too low line voltage can raise the 'noise figure' of the line amp, in some cases very quickly. You will see this increase in amplifier noise as an increase in fine-grain busyness (noise) in the background of the picture. Two possible solutions here; raise the DC operating (line) voltage to a safe level, or, substitute another brand/model of line amp that is capable of operating at reduced (DC) line voltage.

Don't be afraid to measure the DC line voltage with a VOM when you have stretched the cable out and are using an unusually high amount of cable. Depending upon the configuration of the BDC distribution system, you may also be suffering from too-low voltage at the LNA/LNB/downconverter as well, compounding your problems.

A less common problem is too high a line (DC) voltage for the line amplifiers. Remember that you are line powering your BDC equipment from the IF input on the receiver proper. The voltage (and maximum current) available here is established by the receiver's internal power supply. Not all line amplifiers operate within the same voltage range as the receiver provides so before you start an installation, check the available voltage from the receiver to insure that it is within the 'voltage window' specified for the line amplifier.

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